Jefferson Lab
Proposal Cover Sheet (Generic)

Experimental Hall: ______

Days Requested for Approval: ______

Submission Date: 5/94

Other: PAC 8

☐ **New Proposal Title:**

☒ **Update Experiment Number:** 93-049

☐ **Letter-of-Intent Title:**

(Choose one)

Proposal Physics Goals
Indicate any experiments that have physics goals similar to those in your proposal.

Approved, Conditionally Approved, and/or Deferred Experiment(s) or proposals:

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Receipt Date: 5/94 PR 94-035

By: ______

CEBAF EXPERIMENT 93-049

Polarization Transfer in the Reaction $^4\mathrm{He}(\vec{e}, e'\vec{p})^3\mathrm{H}$ in the Quasi-elastic Scattering Region

J.F.J. van den Brand, R. Ent, P.E. Ulmer, Spokespersons

U. of Wisconsin-Madison, CEBAF, Old Dominion University, NIKHEF-K, College of William and Mary, Rutgers University, University of Virginia

This experiment has been approved for 12 days to measure the dependence of the polarization transfer coefficients D_{lt} and D_{ll} as well as the induced normal polarization in the reaction $^4\mathrm{He}(\vec{e}, e'\vec{p})^3\mathrm{H}$, as a function of Q^2 over the range 0.8 to 4.0 $(\mathrm{GeV/c})^2$ and as a function of missing momentum in the range of 0 to 250 MeV/c. The experiment exploits the 100 % duty factor polarized electron beam in combination with the Hall A spectrometer pair. The polarization of recoil protons will be measured in a polarimeter being constructed by a collaboration from the College of William & Mary and Rutgers University, both groups being members of experiment 93-049. Though 93-049 is not officially recorded as a Hall A collaboration experiment, the participants are active in improving upon this experiment, and also in many aspects of preparation for Hall A experiments.

A large fraction of this collaboration is also involved in an analogous $^4\mathrm{He}(\vec{e}, e'\vec{p})$ experiment at lower Q^2 at the Bates Laboratory. Members of the 93-049 collaboration have constructed and tested the Bates focal-plane polarimeter which is now installed in the Bates OHIPS spectrometer and the commissioning experiment for the polarimeter, $^2\mathrm{H}(\vec{e}, e'\vec{p})$, is currently underway. Furthermore, a high-pressure cryogenic target for the Bates $^4\mathrm{He}(\vec{e}, e'\vec{p})$ experiment has been constructed and tested by the University of Wisconsin-Madison and has already been successfully used in an experiment at the EMIN facility at NIKHEF-K. As the Bates and CEBAF experiments are very similar, the Bates experiment will provide valuable guidance for CEBAF, in terms of both instrumentation (polarimeter and target) and physics.

Members of this collaboration are also active in performing absolute beam energy measurement tests. Absolute knowledge of the incident beam energy at the 10^{-4} level is a basic requirement for the Hall A physics program. Measurement of the endpoint energy of backscattered infrared laser light by the electron beam seems a most promising candidate. A scheme to accomplish this has been developed, and test measurements are scheduled for October 1994 in the AmPS storage ring at NIKHEF (where the electron current is a factor of 1000 higher, facilitating an initial test). Beam line modifications have been prepared and a laser optics line has been designed, while a data acquisition system and a High-purity Germanium detector are almost completely available. The vacuum can of the last dipole in the ARC of Hall C has also been modified to enable a later test at the higher beam energies at CEBAF.

Members of this collaboration will also be instrumental in general purpose preparations for the experimental program of Hall A. Results from the Hall C commissioning data can be used to design sieve slits and acceptance limiting slits. Members of this collaboration are in charge of the design of these systems in Hall C, and will perform test measurements to judge the possibility of active slits (densimet backed by a veto scintillator) as acceptance limiters. Also an extensive package of sieve slit analysis software will be developed for Hall C, and can be easily incorporated in the Hall A plans. To further understand the spectrometer performance and the physics derived from measurements, members of this collaboration have been the principals in setting up Monte Carlo simulation codes for coincidence experiments. These Monte Carlo simulation codes incorporate (e,e′) and (e,e′p) physics generators, transport of particles through the spectrometers (including spin transport of polarized protons), and both internal and external radiation processes. The understanding of the latter processes is instrumental for the unfolding of radiative tails from the measured coincidence spectra.